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Software Effort Estimation for Modern Learning Applications using Learning Object Points Method

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Abstract

Background / Objectives: The software project management is a method that involves planning, constructing, monitoring, handling, and directing software projects. In order to complete the software engineering process successfully, flawless planning is necessary. The planning process includes software size assessment, assessment of effort in person hours, calculating cost and budget, preparing schedule, and allocating resources and works. The estimation of software system is extremely significant in planning the software construction process.
Methods / Statistical Analysis: Software system size determines a number of factors such as effort, duration, schedule, cost and etc. For faultless planning, perfect estimation of above said parameters are necessary. Various sizing techniques are used in the software industry to evaluate the software system size.
Findings: These sizing approaches given improper size which affects all estimates like effort, duration, schedule, cost and other factors. The wrong estimates lead incompleteness, loss, delay of project and customer dissatisfaction. An e-learning system is also a program that supports computer-based and internet-based teaching and learning processes, which takes teaching to another level. It includes Storage and accessing provision for teaching and learning material in form of text, video, audio, animation, simulation and others, assessment mechanisms, discussion, fund transfer facilities and other substantial aspects.
Applications / Improvements: Construction of E-Learning system is disturbed due to inappropriate size estimation that affects the planning process of E-Learning projects which leads the failure in project management. To overcome the problem, Learning Object Points method (LOP) was introduced which will support to calculate the size of E-Learning system and estimate other factors like effort, duration, schedule, cost and other factors. This paper highlights about the effort estimation of E-Learning system using LOP method.

Key words: Effort Estimation, Learning Object Points Method, Sizing approaches

1. Introduction

In software development process, software sizing is the process of measuring the amount of a

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software system or module in order to carry out other software project management activities. Planning is the substantial key to the successful completion of software development process. As part of the planning process, software size is assessed, effort is estimated in hours or in months, costs and budgets are calculated, a schedule is prepared, and resources and work assignments are completed. [1-5]. For flawless planning of the development process, the size of the software is very significant since it determines effort, duration, cost, and other things that affects the software implementation [6-10]. To quantify the size of software, the software industry uses a variety of sizing approaches. Lines of code, Feature points, Object points, Function points, use case points, Internet points, and so on are some of the approaches used. These sizing approaches are depending on either the programming language or the programming methodology [11-15]. The sizing technique which is used for assessing the size of the software system to be developed is not effectively determining the size leads towards failure. E-Learning is a software system whose development is in difficulty due to poor size, which has a negative impact on quality and customer satisfaction, causes project delays, and raises development costs. To address this issue, the Learning Object Point Method (LOP) was developed.

2. About Learning Object Points Approach

Learning Object points approach [16] is a process for estimating the size of E-Learning system. The LOP is a unit of quantity for the number of learning objects and working functions a user receives from an e-learning system. This method was developed to resolve the shortcomings of available size estimating methods [17-23]. A large number of input and output transactions occurred in the E-Learning system in the form of registration, submission of learning and assignment content, and so on. For eligibility checks, grading calculations, grouping, ordering, and assessing, there are numerous logical files involved. External components, such as databases, can be connected to our application using interface files. An e-learning system may also be a web application, resulting in a large number of Web pages. The E-Learning system is also linked with lots of screens and reports. It contains a large number of multimedia assets, graphic files, databases, and knowledge transfer via the internet. The LOP approach takes into account all of these features of an e-learning system.

3. System Architecture

To find the Learning object points of software system, three major sub systems are used. They are Learning complexity factor (LCF), Unadjusted learning point (ULP) and Technical complexity factor (TCF). These subsystems include all the characteristics of the E-Learning system [16]. The figure 3.1 gives the architecture of LOP method.

The LOP of an E-Learning application is planned via equation 3.1

$$LOP = ULP * TCF * LCF \qquad \text{(Eqn -3.1)}$$

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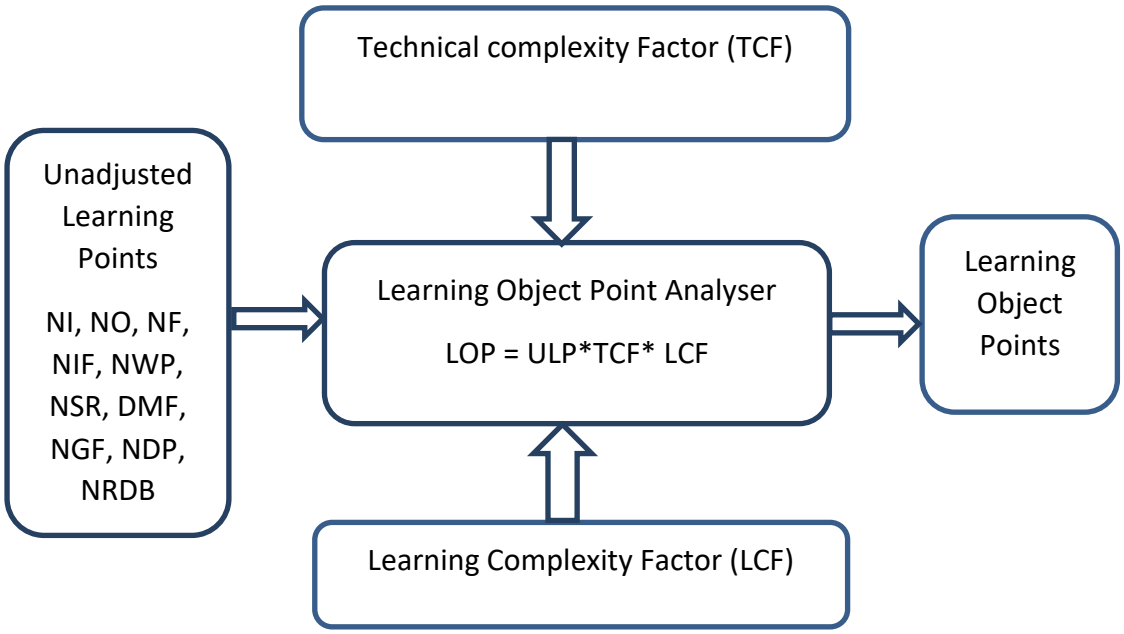

Figure 3.1. Planning of LOP Method

4. Effort Estimation

Software development Effort denotes the quantity of man hours required for successful finishing of the project. The following equation 4.1 is used for calculating effort using Function point analysis-based sizing. Similar formula 4.2 is used for calculating effort using LOP also.

$$Estimated\ Effort(FPA) = FPA * PF \quad \text{(Eqn-4.1)}$$

$$Estimated\ Effort(LOP) = LOP * PF \quad \text{(Eqn- 4.2)}$$

Where FPA = Function Points of an E-Learning system
LOP= Learning Object Points of an E-Learning system
PF = Productivity Factor.

5. Performance analysis of LOP over FPA based on effort Calculation

From those data, the sample set of Nine E-Learning Projects and their size in Function point are documented. Similarly LOP of the same projects calculated by using their requirements document and planning documents. Afterwards effort was calculated using above mentioned equation 4.1 and 4.2.

The following Table 5.1 shows the software project effort requirement of the project calculated using FPA based size, and tabulated the actual effort taken for completion but the actual effort taken out for completion is different than estimated also mentioned. It is proving that FPA based sizing for e-Learning system will not provide adequate results and also it leads towards the failure in project management.

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Table 5.1 software project effort requirement calculated using FPA

Projects	FPA	Effort calculated using FPA	Actual Effort taken for completion	Effort difference between actual and calculated effort using FPA
Project1	114	1824	4375	2551
Project2	124	1984	18000	16016
Project3	133	2128	17775	15647
Project4	152	2432	6350	3918
Project5	171	2736	12700	9964
Project6	188	3008	9025	6017
Project7	226	3616	8500	4884
Project8	238	3808	20000	16192
Project9	253	4048	6780	2732

The figure 5.1 shows the effort calculated using FPA with Actual effort taken for completion. Actual effort taken out for project completion is higher.

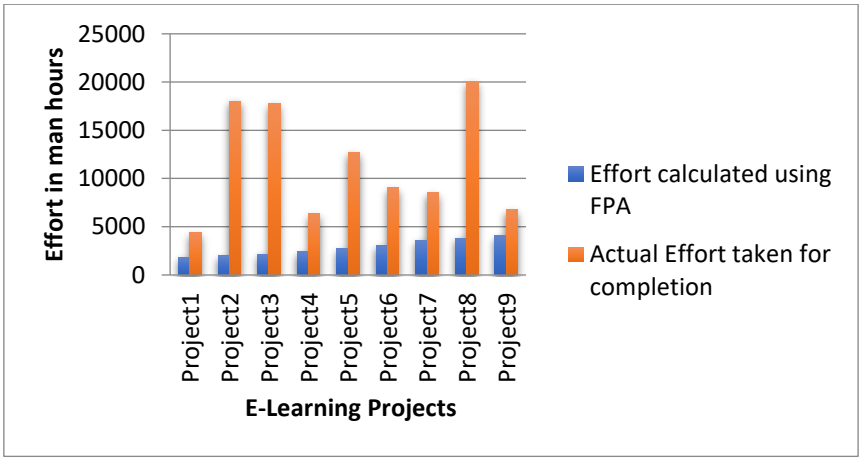

Figure 5.1 The software project effort requirement calculated using FPA with actual effort

The above figure 5.1, clearly stating that the inefficiency of FPA in calculating effort because the basic project size calculated using FPA does not care about the learning content preparation part and the complexity of preparing E-learning system.

The below table 5.2 gives the software project effort requirement calculated using LOP based sizing.

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Table 5.2 software project effort requirement calculated using LOP

Projects	LOP	Effort calculated using LOP	Actual Effort taken for completion	Effort difference between actual and calculated effort using LOP
Project1	274	4384	4375	-9
Project2	1119	17904	18000	96
Project3	1110	17760	17775	15
Project4	400	6400	6350	-50
Project5	791	12656	12700	44
Project6	564	9024	9025	1
Project7	532	8512	8500	-12
Project8	1244	19904	20000	96
Project9	423	6768	6780	12

The following figure 5.2 graphically shows the variance in real effort and projected effort calculated by using LOP based sizing. The difference is very minimal. It does not affect the project management.

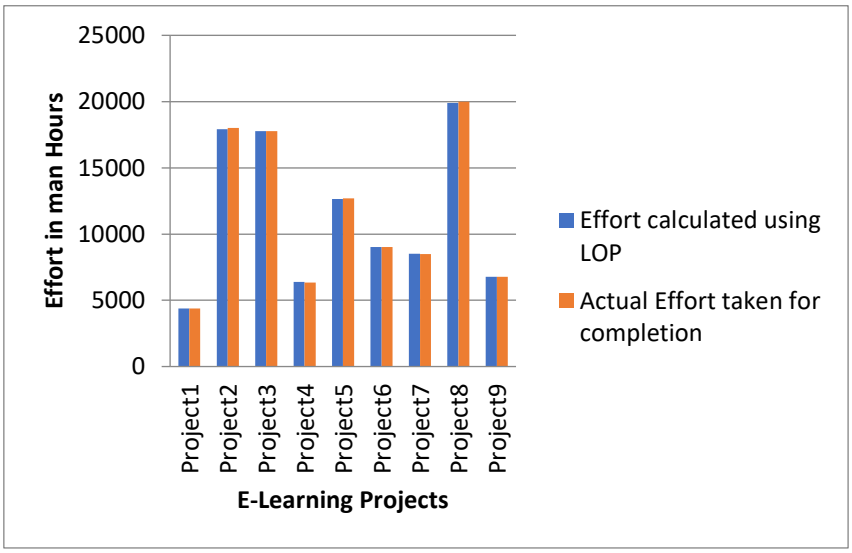

Figure 5.2 The software project effort requirement calculated using LOP with actual effort taken out for completion.

The above table 5.2 and figure 6.2 clearly presenting the efficiency of LOP in calculating effort because the basic project size calculated using LOP is considerate about the learning content preparation part and the complexity of preparing E-learning system. So effort calculated using LOP produced optimal result.

6. Conclusions

Project planning is the first step to manage the systematic development process of software. This stage documents size, resources, staffing levels, cost, time and key check points. The software size is the base parameter used for determining other mentioned factors because software size is involved directly or indirectly for assessing effort, cost, time and other project factors. This paper analysed an advanced method to determine software size in initial stage called LOP Method with effort estimation. It yields an optimal result so It concludes that LOP is one of the effective approaches for sizing E-Learning applications and effort assessments.

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